Small Business Innovation Research/Small Business Tech Transfer

Brine Dewatering Using Ultrasonic Nebulization, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

Recovery of water from brine is critically important for manned space exploration. Resupply of water is prohibitively costly for extended missions. It is anticipated that NASA will pool urine, hygiene water and humidity condensate into a combined waste stream that will subsequently be concentrated into a brine while recovering some but not all of the water, 90-95%. The concentrated brine that results from primary water recovery systems contains a significant amount of water. The proposed innovation will recover virtually all of the remaining water. This will be accomplished by ultrasonically creating nebulized droplets of the brine that can be readily dried under a partial vacuum with moderate temperature microwave heating. The process bears some resemblance to spray drying, but uses much smaller droplets (1.6 m as compared to ~100 m). Small droplets enable quicker drying due to their high relative surface area. This is particularly important when drying wastewater brines which contain ingredients that are thermally labile and require drying at relatively low temperatures. The proposed system has no nozzles to become plugged, requires no chemical additives, uses a minimal amount of power, is simple and small, requires minimal astronaut attention and uses a continuous, closed cycle process that is gravity independent.

Anticipated Benefits

For the private sector, a major application is improved drying processes for pharmaceuticals. Many biologically active compounds are thermally labile and would benefit from the use of this technology for preparation of inhalants. In addition, the ultra-small size of the resulting particles is desirable for inhalation because they are more easily suspended in air and because solvation and uptake through the alveoli in the lungs is more efficient for small particles. For example, NaCl particles are widely used in dry powder inhalers for bronchial provocation tests to identify people with active asthma or exercise-induced asthma. Such powders are currently made using laborious processes to control particle sizes and distributions. The technology developed during this SBIR project will allow continuous formation of small, dried NaCl crystallites, in a process more amenable for large-scale production. The NASA application of this innovative technology will be as Hardware for Lunar Base and other Early Planetary Bases. The partial gravity at these locations will permit nebulization without the use of a wick. Gravity based water accumulation at the bottom of the condenser will be accomplished without the assistance of an air/water separator. This technology will enable efficient water recovery from brines resulting in a major mass closure for water usage on the Lunar Base. Use as Flight Hardware for Transit Missions is also anticipated. With this application, a wick will be used to hold the brine at the desired location during nebulization. An air/water separator will be included to facilitate separation without the assistance of gravity.

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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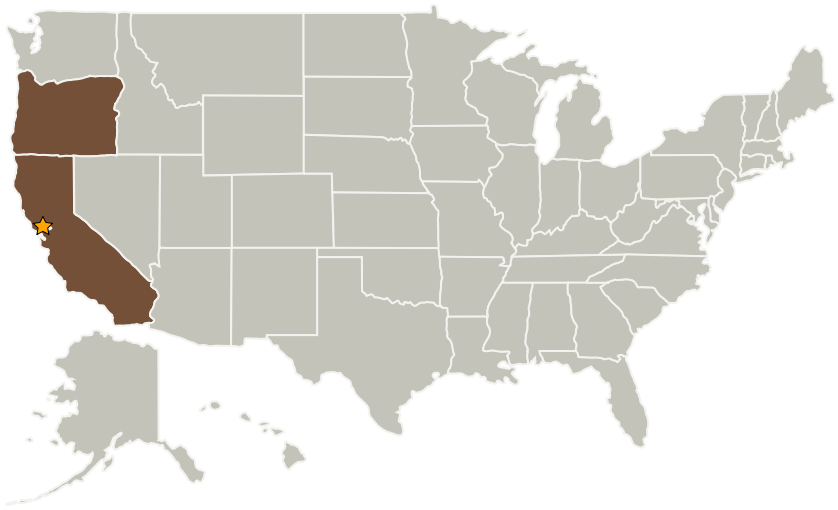
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
UMPQUA Research Company	Supporting Organization	Industry	Myrtle Creek, Oregon

Primary U.S. Work Locations	
California	Oregon

Project Management

Program Director:
Jason L Kessler

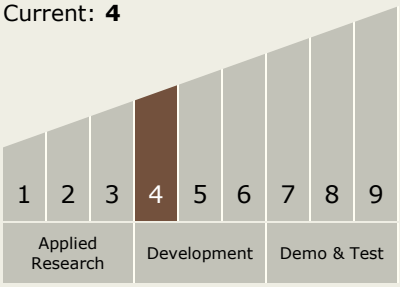
Program Manager:
Carlos Torrez

Project Manager:
John W Fisher

Principal Investigator:
James R Akse

Technology Maturity (TRL)

Start: **4**
Current: **4**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management